What’s an algorithm?

“A procedure for solving a mathematical problem (as of finding the greatest common divisor) in a finite number of steps that frequently involves repetition of an operation.” — webster.com

“An algorithm is a finite, definite, effective procedure, with some input and some output.” — Donald Knuth
What is this course about?

• In CS230, you learnt how to:
  • Abstract functionality from design
  • Design efficient data structures
  • Design modular applications

• You used to,
  • Code all of that
  • Test it to see if it works
  • Then, the fun starts 😁

What is this course about?

• In CS231, you learn the design and analysis of algorithms to solve problems.

• We’ll always focus on three things:
  • How to understand and define a problem
  • How to implement an algorithm that “correctly” solves that problem
  • How to analyze the performance of that algorithm

• The goal is to define correct and efficient algorithms without having to implement and test them.

Remember: You cannot prove correctness by example!
Why take CS231?

Because ... It’s a major requirement!

Really, why?

- Understanding and Remembering:
  - Recognize algorithmic techniques used to solve a problem.
  - Identify the correctness, or lack thereof, of an algorithm.
- Critical Thinking:
  - Dissect new problems to identify their input and corresponding output.
- Practical Thinking:
  - Determine appropriate algorithmic techniques to solve new problems, by relating new problems to ones in their foundation knowledge.
  - Define correct algorithms to solve new problems and prove their correctness.
  - Critique existing algorithms.
  - Calculate the asymptotic run time complexity of new algorithms.
- Projects and Research:
  - Coordinate tasks and collaborate on writing a final paper.
  - Identify high quality scholarly articles, and their contributions.
  - Summarize existing algorithmic research on a topic of their choice
  - Present summary of research to peers, as part of a team.
- Interpersonal Relationships:
  - Collaborate with peers on dissecting new problems.
  - Give feedback to peers on their proofs.
  - Take responsibility for work performed as part of a group.
Class readings

• Your textbook is amazing, and it’s a great resource.

• In almost every lecture, there is required reading to be done before class.

• How should you do that reading before class?
  • First pass (no longer than 15 minutes)
    • Skim the required reading by reading the section and subsection titles, with the first paragraph or 2 of these sections
    • Goal: Know what we’ll talk about in class
  • Second pass (no longer than 45 minutes)
    • If you feel comfortable, read all English description paragraphs
    • Goal: Be familiar with the content, to identify points that you need to focus on in the lecture
  • Third pass (no longer than 1 hour)
    • Read the proofs
    • Goal: Good practice for more advanced parts of the course
Assignments

• Schedule
  • Usually posted on Friday
  • Due the 2 weeks later (usually Friday at noon)

• Submission
  • Write your assignments in latex, try overleaf.com
  • You will be provided with a Latex template every assignment
    • Template must be used as a starting point
  • Upload pdf on your CS231 assignment link in Gradescope

• Proof modules
  • In some assignments, you will find a problem marked with [Proof-problem]
  • For these problems, you need to carefully formulate and write your arguments for the correctness of your solutions.

Summary ...

• All other assignment submissions will be done using Gradescope.
  • You’ll get an email this week.

• Assignments must be in PDF format, using Latex.
  • You can use overleaf.com

• We will adopt an automatic 24-hour late submission policy.
• Late submissions beyond that need to be communicated with me before the fact.

• All communication will be done using Piazza.
  • You’ll get an email this week.
Exams

- You’ll have three exams during the semester,
  - Virtual
  - Pick Your Own Time over a specific weekend
- All exams are open-book and open-notes
- There will be no final exam.
  - Instead, there will be a final short paper and poster presentations.

It contains all course info
- The schedule for the semester
- Office hours discussion sections and help room
- The course syllabus
- Make sure you check it often
- Let’s take a quick look
Now, let’s review some data structures

Remember arrays and linked lists? 😊